



Vertical integration for climate change adaptation in the water sector: lessons from decentralisation in Africa and India

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Abstract

Vertical integration, which creates strategic linkages between national and sub-national levels, is being promoted as important for climate change adaptation. Decentralisation, which transfers authority and responsibility to lower levels of organisation, serves a similar purpose and has been in place for a number of decades. Based on four case studies in semi-arid regions in Africa and India, this paper argues that vertical integration for climate change adaptation should reflect on lessons from decentralisation related to governing natural resources, particularly in the water sector. The paper focuses on participation and flexibility, two central components of climate change adaptation, and considers how decentralisation has enhanced or undermined these. The findings suggest that vertical integration for adaptation will be strengthened if a number of lessons are considered, namely (i) actively seek equitable representation from marginal and diverse local groups drawing on both formal and informal participation structures, (ii) assess and address capacity deficits that undermine flexibility and adaptive responses, especially within lower levels of government, and (iii) use hybrid modes of governance that include government, intermediaries and diverse local actors through both formal and informal institutions to improve bottom-up engagement.

Keywords Decentralisation · Water governance · Vertical integration · Participation · Flexibility · Climate change adaptation

Introduction

National Adaptation Plans (NAPs) have prioritised the need for cross-scalar approaches for planning, implementing and monitoring climate change adaptation. This has been supported by the Paris Agreement that has prioritised the involvement of subnational governments in climate action (Hsu et al. 2017). This process of creating intentional and strategic linkages between national and subnational levels on climate

adaptation planning and implementation is commonly referred to as vertical integration or vertical coordination (Dazé et al. 2016; Pahl-Wostl and Knieper 2014).

Although NAPs often focus on technical responses, the recent emphasis on vertical integration reflects the growing recognition that coordination and collaboration across all levels and sectors need to be improved to strengthen adaptation to climate variability and change (Biesbroek et al. 2014; Frohlich and Kneiling 2013). These multi-level and cross-

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sectoral decision-making processes are required to achieve effective governance to reduce climate change impacts, particularly in the water sector (Pahl-Wostl and Knieper 2014). Local priorities and expertise need to feed into sub-national and national adaptation processes, requiring flexibility and an explicit focus on participation (Adhikari and Taylor 2012). However, given the relatively recent focus on climate change adaptation governance and implementation, there are limited examples of what it means to adapt at the local level and collaborate across scales (Adhikari and Taylor 2012).

Decentralisation has many parallels with vertical integration. It emerged in the 1990s and has been implemented in many countries, particularly for natural resource management. It foregrounds coordination across scales by transferring responsibility of decisions and resources from the central government to lower-level governmental organizations and community organizations (Pahl-Wostl and Knieper 2014). As Fauguet (2014:2) states, decentralisation 'is one of the most important reforms of the past generations, both in terms of the number of countries affected and the potentially deep implications for the nature and quality of governance'. As vertical integration approaches are developed for climate change, lessons can be learned from how decentralisation has enabled or undermined participation and flexibility across scales. Yet, insufficient attention has been paid to this so far.

The water sector provides a good entry point for looking at both decentralisation and vertical integration for climate change adaptation. Water is a resource directly linked to climate variability and impacted by climate change (Jiménez Cisneros et al. 2014). Water, which is core to life, needs to be managed in a coordinated and flexible way across scales from the national, to regional, to local levels (Pahl-Wostl and Knieper 2014; Woodhouse and Muller 2016). Adaptation responses that reduce climate risk in the water sector at the village or sub-national level need to be situated within institutional structures and procedures that are shaped by rules and decisions made by other levels of government (Vogel and Henstra 2015). Understanding the rules of water governance at different levels can help ensure that local climate change adaptation is not restricted by the higher-level institutional processes in which they are embedded (Juhola et al. 2011). Failure to achieve coordination between these different levels may result in maladaptation and increased vulnerability due to conflicting goals, decisions or actions (Magnan et al. 2016). Decentralisation, which has been extensively implemented in the water sector, can provide lessons for climate adaptation across scales.

This paper draws on four case studies of decentralisation in the water sector in semi-arid regions in Africa and India, to put forward lessons for vertical integration for climate change adaptation. Specifically, it focuses on lessons around participation and flexibility. Participation and cooperation are central tenets of decentralisation that emphasise the importance of

recognising and integrating a wide range of perspectives and knowledge (Fauguet 2014; Woodhouse and Muller 2016). They have also been identified as critical for effective and inclusive climate change adaptation (Few et al. 2007; Singh 2018). Decentralised water management, which supports local decision-making, supports flexibility because of its aim to respond more immediately and directly to local needs. Because flexibility is an important characteristic of being able to adapt to changing climate (Pelling 2011; Baudoin and Ziervogel 2017), the extent to which it has been enabled by decentralisation in the cases is explored.

The central argument of this paper is that vertical integration for climate change adaptation needs to look closely at how decentralisation has enabled or undermined the ability to support participation and flexibility across scales. The objective of this paper is to review four local cases of decentralisation in the water sector in semi-arid regions through the lens of participation and flexibility as two important components of vertical integration. In the next section, we present the conceptual foundations of decentralisation and vertical integration for climate change adaptation, before presenting our analytical framework of how the two concepts overlap. We then present four cases, all linked to the ASSAR (Adaptation at Scale in Semi-arid Regions) project. The project used insights from multiple-scale, interdisciplinary work to improve the understanding of the barriers, enablers and limits to effective, sustained and widespread adaptation out to the 2030s. The semi-arid nature of the case study regions means that water scarcity and its governance are one of the critical challenges to climate change adaptation (Few et al. 2015; Padgham et al. 2015; Revi et al. 2015; Spear et al. 2015). After presenting the methods used to assess the cases, we focus on how sub-national actors, including rural households, have engaged in water governance and have been impacted by decentralisation. The results and discussion explore how participation and flexibility have been supported or undermined across the cases. Drawing on this, we present three lessons that should be considered when implementing vertical integration for climate change adaptation.

Conceptual framework

Vertical integration for climate change adaptation

The complex interactions of changing trends in both gradual and extreme weather events, alongside changing social-political landscapes, economies and demographics, are increasingly forcing governments and other actors to reimagine the way natural resources are managed and governed. Although there are increasing pressures on water availability due to increasing temperatures, evapotranspiration and changes in rainfall variability, many scholars have highlighted that

adaptation to climate change is as much a governance issue as a technical issue (Adger et al. 2009; Biesbroek et al. 2014). Given the complexity of the climate change challenge, new forms of climate change governance are emerging, including multi-stakeholder forms of regulation (e.g. public-private partnerships or platforms for collaboration). In the context of water governance, Pahl-Wostl (2007) traces marked paradigm shifts from a 'prediction and control' mechanistic approach, to a more cyclical and learning centric adaptive approach. The latter involves reorganization and strengthening networks to enable adaptive processes that help understand the 'system' of intervention (Berkhout et al. 2006).

Those working on climate adaptation have often been frustrated with the lack of nestedness between various policies and programmes at different levels and the persistence of redundancy across different sectors. Vertical integration is increasingly being supported because it aims to address this shortcoming (Dazé et al. 2016). One factor needed to enable vertical integration is the institutional arrangements that link different levels of decision-making. It is through these institutional arrangements that coordination, capacity building and communication between different levels occur. However, initial climate governance experiments are throwing up challenges, such as tensions between formal and informal rules and hierarchies based on underlying power configurations (Termeer et al. 2016).

In addition to acknowledging the need to work across scales, adaptation responses must support flexibility and iterative learning processes to embrace uncertainty and shape governance to achieve better outcomes (Folke et al. 2002). Despite theoretical calls for adaptive governance, practitioners and policy makers continue to struggle in defining and operationalizing learning goals and flexible decision-making (Armitage 2008). This is partly because it is hard to translate complex and nested concepts into practice, especially when contextualizing goals locally (Huiteima et al. 2009). The other widely observed hindrance to flexibility stems from the inherent rigidities in organisational structures, which are in turn embedded in organisational and operational histories (Huntjens et al. 2012). The push for vertical integration to work explicitly with actors beyond government provides promise for experimentation, innovation and increased flexibility.

Decentralisation and water governance

Decentralisation entails (i) transfer of power from central authority to actors and institutions at lower levels, (ii) representation from lower levels of hierarchy, and (iii) bringing local knowledge into decision-making processes to increase a sense of ownership over decisions taken (Larson and Ribot 2004). The decentralisation paradigm has shifted the discourse away from 'national cohesion, effective rule, efficient management

of rural subjects', to the world of 'emancipatory language of democracy, pluralism, and rights' (Larson and Ribot 2004:1).

This shift of power to lower levels has seen participation emerge as a central theme in decentralisation. Thus, decentralisation is seen 'as a way of increasing participation and strengthening democracy' whilst contributing to multiple development issues (Conyers 2017:vii). To enable this, community-based approaches have been promoted as a way to manage natural resources effectively across Asia and Africa (Benjaminsen 1997; Larson and Ribot 2004; Ribot and Larson 2013; Mohmand and Loureiro 2017; Singh 2018). Flexibility across scales is seen as integral to implementing these locally appropriate responses. However, some argue that participation may undermine flexibility when convening broad groups with heterogeneous needs (Engle et al. 2011).

In theory, decentralisation is expected to improve service delivery, democracy and inclusivity (Faguet 2014); increase transparency and accountability; reduce central government expenditures (Mohmand and Loureiro 2017); improve resource management through stronger ownership; and provide more participatory and deliberative spaces for decision-making (Mohmand and Loureiro 2017). However, in practice, limited participation (Dyer et al. 2014), elite capture (Persha and Andersson 2014), mismatch in government/donor and local agendas (Larson and Ribot 2004; Faguet 2014), resource constraints and capacity deficits, and incomplete and token devolution (Mohmand and Loureiro 2017) have been evident.

In the past decades, water management has witnessed significant shifts from centralisation to decentralisation (Mehta and Movik 2014; Gupta et al. 2013). Despite its intentions, decentralisation in the water sector has often not resulted in enhancing local decision-making (Gupta et al. 2013). Despite financial devolution in some cases, overall financial and human resource transfers to lower levels have been sparse (Marks and Lebel 2016; Mapedza et al. 2016). It is often unclear who is taking on which roles and responsibilities between different actors and institutions at various levels, creating coordination deficits and conflicts horizontally and vertically (Jackson and Gariba 2002).

Understanding how decentralisation has been implemented in the water sector to meet local needs provides insight into how flexibility, representation and engagement at the local level has been achieved in practice. Given the importance placed on local knowledge, participation and flexibility in the climate adaptation literature (Naess 2013), this experience in the context of decentralisation is important to draw on when supporting vertical integration for adapting to climate change.

Local water governance through the lens of decentralisation and vertical integration

On the whole, decentralisation has not been as effective as intended (Terry et al. 2015). Both the degree of participation

hoped for and the ability to be flexible at the subnational and local scale have tended to be limited. Vertical integration for climate change adaptation therefore needs to be cautious about promises of what participation might deliver in practice (for example, Thomson 2016 in Uruguay; Marks and Lebel 2016 in Thailand; Singh 2018 in India). Similarly, the flexibility called for by climate adaptation research needs to be carefully thought through in terms of how vertical integration might support this (Engle et al. 2011).

Figure 1 illustrates the conceptual framework used to assess the four cases in this paper. It suggests that lessons on how participation and flexibility have been supported through decentralization in the water sector should be drawn on for developing vertical integration approaches in the climate change sector. Overlaying the priorities for decentralisation with those from climate adaptation illustrates areas of commonality where lessons can be learned.

Case studies and methodology

Decentralisation, water governance and climate adaptation: case study contexts

This section discusses the water resources and governance context in the four case studies from the semi-arid regions of southern Africa (Namibia, Onesi Constituency), West Africa (Ghana, Lawra District), Eastern Africa (Kenya, Isiolo County) and India (Karnataka State, Kolar District) (Fig. 2). The case studies cover different semi-arid regions presenting a wide range of vulnerabilities and water management challenges across Africa and Asia. The diversity across cases, including both the context of livelihoods and water resource availability and differences in the methods used, means that it is not suitable to compare cases directly. Rather, this paper engages with the cases as examples of how decentralisation of water governance in semi-arid regions has enabled

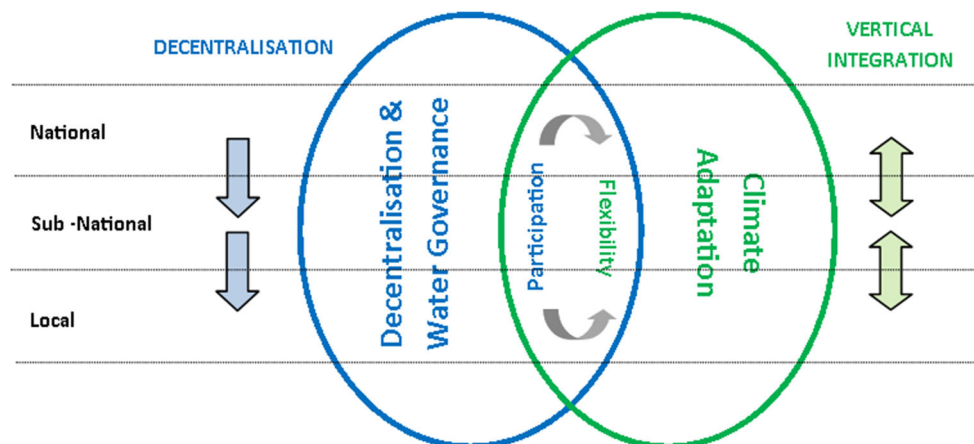
participation and flexibility, particularly at the local level. The qualitative analysis draws on themes of participation and flexibility to pull out lessons to consider when developing vertical integration approaches for climate adaptation.

For each case, we present a brief overview of the issues related to water resources in terms of climatic and non-climatic stressors and water management policies, structures and practices. The supplementary material further summarises the national context of decentralisation, water governance and climate change adaptation in the four case study countries.

Ghana

In Ghana, water sector policies for urban and rural areas are established by the Water Directorate within the current Ministry of Sanitation and Water Resources. The Water Resources Commission regulates water resources and licenses water abstraction. In the early 1990s, as part of its decentralisation reform to devolve power and resources to the district level and to promote popular participation in governance, the Government of Ghana restructured water and sanitation delivery agencies (Ayee 1997). This approach separated the management of piped water in cities from schemes in small towns and rural districts, and sanitation became independently managed. Urban water supply was directly managed by the Ghana Water Company Limited (GWCL) until a subsidiary company (Ghana Urban Water Limited) was established by the Government of Ghana in 2011 to manage it (Acheampong et al. 2016; Suleiman and Khakee 2017). For rural areas (Rural and Small Town Water Supply Schemes), the District Assemblies manage supplies through various schemes depending on population size, i.e. Small Communities Point Sources (between 75 and 1200), Small Community Piped Systems (1201 to 2000) and Small Towns Piped Systems (up to 50,000) (Kumasi et al. 2018). The Community Water and Sanitation Agency is mandated to facilitate the provision of safe drinking water and related sanitation services to rural communities and small towns. Overall, District

Fig. 1 Conceptual framework: participation and flexibility as the synergies between decentralisation and vertical integration



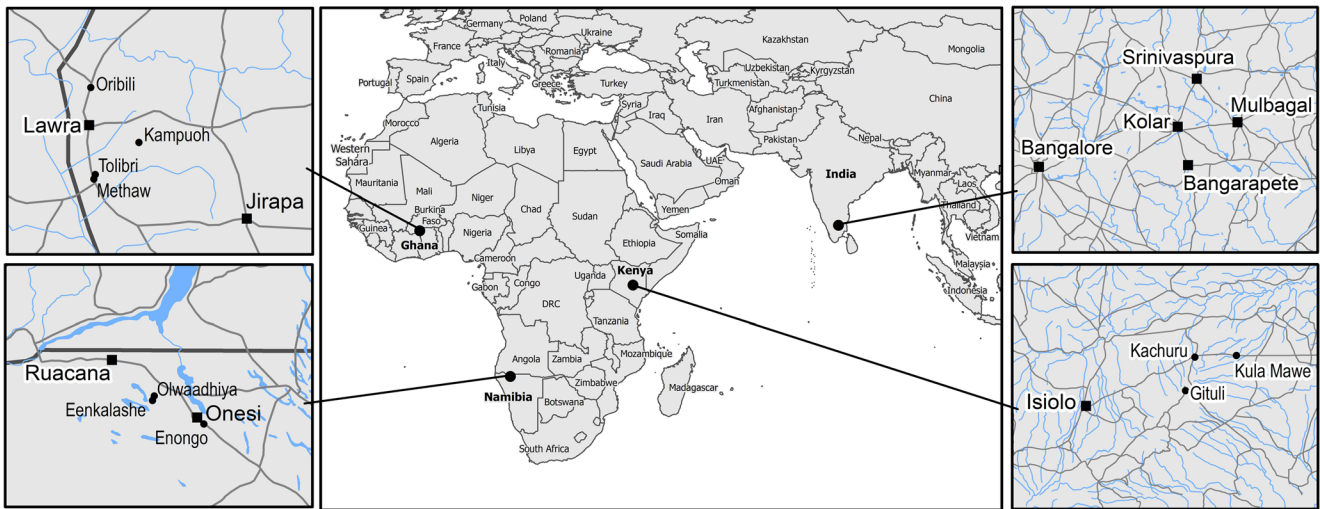


Fig. 2 Location of case study sites in Ghana, Kenya, Namibia and India (source: Eduaction)

Assemblies play a key role in providing the service, leading participatory planning processes and mobilising skills and resources from a wide range of state and non-state actors (Laryea-Adjei and van Dijk 2012).

The lowest level of governance in rural areas, such as those in the case study site of the Lawra District of the Upper West Region, is the Water and Sanitation Development Boards in small towns and the Water and Sanitation (WATSAN) Committee in rural communities, who work in conjunction with the Community Water and Sanitation Agency through the District Assemblies. The WATSAN committee, which comprises chiefs, women representatives, unit committees and assemblymen among others, prioritises monitoring of domestic water sources and is responsible for defining and enforcing regulations, maintenance of facilities and collection of tariffs (FitzGibbon and Mensah 2012). Traditional authorities, including paramount chiefs, sub-chiefs and community elders, play an important, albeit informal, role in these processes since local communities are unaware or uninformed about formal regulations and willingly comply with customary and religious water regulations.

Kenya

Following the promulgation of the 2010 constitution, Kenya has undergone governance reforms, with the decentralised administrative set-up of the country organized through 47 semi-autonomous counties. Decentralisation is characterised by the devolution of power to lower administrative levels whereby central government has consciously created and strengthened the structures of counties and local units of government to lessen its direct control. Consequently, key functions of the national government have been devolved at varying degrees, including in the water sector. While the process of decentralisation has been slow and incomplete, further

compounded by the controversial national elections of 2017, provisions in the country's 2010 Constitution stipulated a devolved governance for the stewardship of water and other natural resources. While Kenya had existing customary institutions managing water and pasture at the local level and the concept of Water Resource Users Associations started in the late 1990s, it was the 2002 Water Act that provided more decentralised power to the local communities (King-Okumu et al. 2018). Further decentralised reforms and policy development in the water sector continued after the new constitution (e.g. promulgation of the new Water Act in 2016, GoK 2016; and development of the National Water Master Plan 2014-2030, GoK 2014).

Currently, there are various actors and institutions that govern water resource management at the national and sub-national (county) levels (Annex 1). In general, there is a shift towards bottom-up water governance through the notable stories of the Water Resource Users Associations at the sub-catchment level supported by national institutions such as the National Drought Management Authority and Water Resources Management Authority, which have regional and county level offices. At the local level, there are water projects and water committees for ground water management, and customary institutions such as Dedha committees for the management of water and pasture. There are also the Water Department and other related departments (e.g. Agriculture, Forests, Tourism) of the county government at the sub-national level. Additionally, other actors are involved at the county and village levels in the water sector, especially development agencies (global development institutions, bilateral organisations and international non-governmental organisations implementing projects) and private sector actors (e.g. private water vendors, transporters, contractors and others providing maintenance of water infrastructure, and water supply distribution in urban areas).

Namibia

Immediately after its independence in 1990, the Namibian government reviewed its water legislations and decentralised some aspects of water governance (Schnegg and Bollig 2016). Being one of the driest countries of southern African, along with immense pressure on the government to address issues of poverty and social inequalities, Namibia needed new forms of governance and water management systems.

The legislative reform attempted to increase participation and engagement at the village, constituency and sub-national levels through the revision and development of various policies that guide the administration and development of the water and sanitation sector in Namibia. As part of the water reform, new governance and management institutions were established. The Namibia Water Corporation Limited (NamWater), a state-owned company that works with the Directorate of Water Supply and Sanitation Coordination (DWSSC), was formed to supply bulk water (GRN 2008). In 2013, Basin Management Committees were introduced to promote community participation in basin management activities. At the regional level, Regional Authorities and DWSSC are responsible for supplying water to rural communities, while Local Authorities (Town Councils) are responsible for water supply and networking within urban areas (Dietrich 2016). In 1997, the national government handed over the responsibility for managing and paying for water services to rural communities through the Water Point Associations. This was an attempt to actively support community participation, as Water Point Associations had to make initial decisions around how water tariffs were structured. The infrastructure was transferred to the Water Point Associations, who are responsible for maintenance, coordinating access and monitoring of the standpipes in villages and facilitating the payment of user fees (see Hossain and Helao 2008; Schnegg et al. 2016).

India

In India, water management is constitutionally mandated in the state list making it a sector governed at a sub-regional scale¹. The state of Karnataka is often identified as an example of effective decentralisation (Pius Kuliposa 2004; Meinzen-Dick 2007; Vaddiraju and Sangita 2011); it has devolved all functions eligible for devolution (amounting to 29) to the *Gram Panchayat*, the basic unit of local governance in India.

Within Karnataka, we focus on Kolar, a drought-prone district colloquially known as the ‘land of milk, silk and mangoes’. Livelihood transitions and land use land cover changes mirror local narratives of decreasing water availability and access (Purushothaman et al. 2013; Singh et al. 2016).

¹ However, several issues such as cross-state river interlinking fall under the Concurrent List, which falls under national governance.

Several State-led interventions aimed at improving natural resources management and strengthening livelihoods are moving towards integrated resource management with a focus on local participation. However, a constant challenge to decentralisation has been inadequate capacity, especially at the lower scale, to implement programmes operating across multiple line departments and skill sets (also see Aziz 2000; Purushothaman et al. 2013). District-level institutions are mandated to regulate and maintain water infrastructure and usage as well as implement central schemes such as the National Rural Drinking Water Program (NRDWP). Additional roles include preparation of contingency plans and drought proofing and mitigation, for example through door-to-door and public supply of drinking water in summer. These formal institutions intersect with informal norms of water sharing and management practices from a range of sources (see Annex 1). In practice, water access and use are strongly filtered through social stratifications, most often caste and gender. For example, wells in a village are often demarcated as belonging to certain social groups (Mosse 1999) such as those belonging to *gowdas* (landowners) or *banjaras* (nomadic communities).

Methodology

This paper draws on qualitative data collected by a team of ASSAR researchers between 2015 and 2017 in semi-arid regions of Ghana, Kenya, Namibia and India. A multi-scalar governance lens guided this research, which required working across scales, paying attention to context, and a focus on the sub-national and local levels (Cash et al. 2006). This approach allowed researchers to acquire rich contextual detail in order to understand people’s perspectives and the complexities of governance (Eakin 2006). Data collection included in-depth interviews, focus group discussions, participatory methods and analysis of secondary data (Patton 2002), which are outlined in detail in Table 1. Most interviews were done in the local language with translation.

Research was conducted with decision makers at the national, sub-national and local levels including local government and non-government staff, water point associations, traditional authorities and local community members to build a better understanding of the decision-making processes around water governance and climate change adaptation. The interviews were designed to understand the roles of different actors and their perceived influence and capacities for improved water resource governance. Data from both the interviews and focus group discussions were analysed through thematic analysis, according to dominant narratives around participation, flexibility and cross-scalar governance. Because of their richness and diversity, information about the livelihoods, water resources and water governance is provided alongside the methodology in Table 1.

Table 1 Case study field sites

Case study context	Ghana	Kenya	Namibia	India
Field sites	Lawra District, Upper West Region; 4 villages	Isiolo - county level; 2 villages (Kula Mawe and Kachumu) in the Ewaso Ng'iro North river basin	Onesi Constituency in Omusati Region; 3 villages (Enongo, Olwaadhiya, and Enkalashe)	Kolar District, Karnataka; 9 villages
Methods	Semi-structured interviews (160) with households and gender differentiated focus group discussions (16) with community members	Semi structured key-informant interviews and focus groups (26 in total). Key informant interviewees mainly included officials from the County government departments (Water, Planning, Agriculture, Livestock), Ewaso Ng'iro North River Basin Development Authority, National Drought Management Authority, Water Resources Management Authority, Caritas International and Fight Against Hunger. Follow-up interviews were also undertaken with some of these actors, where necessary, to validate the information provided Focus group discussions (8) with the village members, water point committee and Water Resource Users Association members and village elders, transect walks, village resource mapping	Semi-structured interviews with village members, government officials and NGOs (24). This included representatives from Nam Water, the Olushadnja Basin Management Committee, the Directorate of Water Resources Management, the Directorate of Water Supply and Sanitation Coordination, the Disaster Risk Management Committee, the Omusati Regional Council the Onesi Constituency Office, the Traditional Authority and the Water Point Committees Focus groups undertaken in each village with around 20 people in total. Participatory Rural Appraisal tools used including Resource Use Matrix, Participatory Village Resource Mapping and Governance walk	Village profiles (9) involving semi-structured individual interviews, transect walks, village resource mapping. Semi-structured interviews with government officials, NGO staff, local researchers (10) Gender-differentiated focus group discussions (18) mapping key operational schemes
Secondary data	Government reports and census data	Government and organisational reports	Government reports and census data	Government reports, district and state development plans
Development context	Rural	Rural—Urban (transitional) but mostly rural	Rural	Transitioning rural with increasing connectivity to urban areas
Primary livelihoods	Agriculture (mixed farming: rearing livestock is a means to supplement the low yield from crop farming); craft and related trade; service and sales	Pastoralists and agro-pastoralists (crop production limited due to climatic conditions); wage labour; charcoal producers and sellers; other informal sectors	Subsistence farmers—crop production and livestock keeping; informal sector includes running 'cuca shops' (selling liquor)	Agriculture and allied sectors (livestock rearing, sericulture), non-farm labour within and outside the village; contractual labour at construction sites and textile industries
Annual rainfall	< 1000 mm	< 150 mm	470 mm	486 mm
Water sources	Boreholes, protected and not protected wells, dugouts (shallow wells), rivers, dams, piped water	Rivers, community ponds, wells and groundwater—boreholes	Groundwater, surface water (i.e. rivers, oshanas or canals, earth dams, shallow wells, open canal), hand dug wells	Government-financed borewells or through private tanker owners, village ponds and tanks, communal wells and grazing lands
Nature of water access	Communal boreholes (constructed by the District Assembly with support from government, NGOs and projects)—accessible to all who contribute towards management Surface water sources (rivers and dugouts)—communal use Communal pipe-borne water—pay before use	Communal – water points/water schemes, drilled boreholes with water storage and distribution systems Traditional community ponds and water pans Private—standpipes in urban areas (Isiolo town)	Communal—communal water points/standpipes in the village Communal—drilled boreholes in cattle posts Private—private off takes in homes that can afford it Hand dug wells managed by the owner but water can be shared with neighbours Government—provides water during critical times i.e. droughts	Communal wells, borewells and taps built by government Government-provided water tankers during summer/drought Communal man-made tanks which are mostly defunct Private—borewells, water purchase in the summer from nearby towns
Village level water governance	Water committees formed by representatives of water users in towns (WATSAN)	Water point committees in consultation with elders—ground water; Water Resource Users	Water Point Committees at the village level, Water Users Associations Local Water Committees (for pipeline schemes)	Water Users Associations (WUAs) Watershed Development Committees (WDCs)

Table 1 (continued)

Case study context	Ghana	Kenya	Namibia	India
arrange-ments	Farmer Associations and Landlords—manage the rivers, dams and dugouts	Associations—surface water (sub-catchment level)	Local Water Associations	
Water-related challenges	Increasing drought conditions in addition to erratic rainfall patterns. Groundwater is a good water source however, few boreholes serve communities (inadequate funds for constructing new boreholes and to maintain existing ones). Heavy reliance on donor agencies to fund boreholes. Some conflicts at boreholes between various users (e.g. ruminant owners and livestock farmers)	Increasing drought conditions and water stress; congestions at the water points; intensification of water demand for commercial cultivation and industrial use; competition for water use (between household use and irrigation agriculture, and between human, livestock and wildlife); and conflicts over grazing and water between the pastoralist groups	Increasing drought conditions and water stress; salinity, vandalism of water infrastructure Heavily relied on surface water supplied through pipeline schemes; unreliable supply of water during summer Distance to paypoints, volunteering nature of WP management, defaulting of user fees and closure of communal water points motivates a move to private off-takes for well off households while affecting access to potable water for marginalised groups	Recurrent droughts and plummeting groundwater levels to as deep as 1200–1500 ft. Inadequate and unreliable water supply for agriculture, and allied activities and domestic consumption (especially during the summer months—April to June). Management of natural resources—shrinking forestland and pasturelands, mining activities, which have implications on incentives to maintain common resources such as village ponds

Results: participation and flexibility in decentralised water governance

This section unpacks how participation and flexibility have been supported or undermined across the four cases in the context of decentralisation in the water sector. Participation is defined here as the extent and nature of engagement of diverse actors in water governance. Flexibility refers to the agility to move between different responses to manage water-related issues depending on changing water resources, institutional and community priorities, and social changes (Massoud et al. 2009; Tomkins and Adger 2006).

Cross-scalar representation helps strengthen participation

Representation of diverse voices, including the most marginal and vulnerable communities, is key to constructive participation (Cornwall 2008). Across the four cases, we explore how marginal communities have been represented in the context of decentralised water governance. In both Ghana and India, women's representation in WATSAN committees and *Gram Panchayats*² respectively is promoted through reserving seats in local bodies for women and those from marginalised groups. Although this has reshaped the contours of participation, in both cases, entrenched socio-cultural norms have made female representation on village committees tokenistic. In the Kenyan case, institutional guidelines and mandatory requirements for inclusion of marginalised groups have facilitated participation, for example through the structures of water point committees and Water Resource Users Associations at the local level and the provision of public consultation at the county level. Through these institutional shifts, pastoralists, agro-pastoralists, women and youth have also become more engaged in local and county level water governance issues, although their real influence on final decision-making is still limited.

Representation across different organisations and across scales of administration in the landscape of water governance is crucial. Across all four cases, there has been a growing presence of non-state actors that are helping to mobilise and facilitate participation at the local level. For example, non-governmental organisations (NGOs) like MYRADA in Karnataka, India and international NGOs such as World Food Programme in North Ghana, Caritas in Isiolo, Kenya, and Red Cross in Northern Namibia have all engaged at the local level and supported local participation to some extent. These NGOs have helped to increase collaboration across

² Lowest level of governance in the three-tiered system in India. A Gram Panchayat typically oversees a group of villages and is managed by a *Gram Sabha* (Village Committee).

scales to fill the gap where local government has been struggling to maintain high levels of participation at the local level. Even though the local government has struggled to enable participation, in our cases, the government has often worked closely with intermediaries, such as NGOs.

Along with the institutional structure, it is also often the agency of certain individuals that can increase representation (Ziervogel et al. 2016). ‘Local champions’ (acting as individuals or representatives) can be central to promoting representation and collective interests of some groups by leveraging their networks and influence. The assertive influence of such local champions is often mediated by a combination of factors such as social context (caste politics in India) and personal attributes of individuals such as charisma, leadership ability and appeal. In Namibia, of the three villages where we worked, the one with the most charismatic leader was the village where concerns were transferred to the higher regional level. Among Borana and Turkana pastoralist groups in northern Kenya, local champions of various sorts, such as a community leader, an influential school teacher, and a NGO staff, often rooted at the local level, have played a key role in bringing different groups’ voices to the fore and leveraging village-county linkages thus facilitating cross-scalar participation.

Political and/or leadership affiliations impact on whose cause the champion supports, which is similar to what Adhikari and Taylor (2012) found. In the Kampuoh community, in Lawra District, northern Ghana, the leader of the women’s group had strong political affiliations and was outstanding in advocating for water and farming solutions for her community. This led to better water infrastructure in her community than in some of the surrounding ones. Given the expected disproportionate impacts of climate change on some more than others, better means of representation are needed to ensure those most vulnerable get represented and heard.

To move from tokenistic to inclusive participation across scales, innovative ways are needed to ensure representation of diverse groups and needs. Participation to support vertical integration will need to engage with power imbalances that traditionally exist both across and within different levels. A quote from Namibia illustrates how youth, for example, have found it hard to engage in the current structures, with one participant saying ‘It is difficult for young people to have a say. Sometimes the local leader can chase you if you are challenging him in a meeting’. In the Ghana case, one community member explained, ‘we are hardly ever consulted during the implementation of projects, especially when it comes to the siting and naming of the [water] services. For example, the Ketro borehole constructed between two communities was named after one community ... and caused problems between them. It was only resolved with the help of the District Assemblies’.

In our four cases, emerging hybrid modes of partnership have provided innovative opportunities to bridge scales and

ensure flow of expertise and experience between relevant sectors that has increased representation. For example, public-private networks are emerging such as the Karnataka State Water Network in Karnataka (India) that is a state-wide network convening stakeholders to coordinate around water management³. In Ghana, irrigation farmer associations and landlords located near the Black Volta River collaborate with the Water Resources Commission to ensure safe farming practices. Inter-county dialogues on water management at the basin level (e.g. between Isiolo and Meru) in Kenya is another case in point that shows how managing natural resources such as water requires going beyond the conventional administrative boundaries to the ‘waterscape’ across administrative scales.

Capacity to implement decentralisation needs to be strengthened

Capacity is a theme that relates to participation and flexibility both in the decentralisation and climate change adaptation fields. Decentralisation is undoubtedly easier said than done. It is complex and thus demands capacity to be built across cognitive and practical realms in order to translate the administrative guidelines of decentralisation into desirable outcomes of effective and inclusive water use and management at the local scale (e.g. Tropp 2007).

Capacity is needed to operate effectively within and outside the formal governance frameworks. All four cases highlight severe human resource deficits coupled with inadequate leadership, knowledge and technical skills within the concerned government line departments across scales. This is especially so in local (village/community) and sub-national (district, state or county) levels. In Kenya, while there are increased financial resources at the county level, lack of technical know-how and capacity deficit remain major constraints, as highlighted by a number of county department officials interviewed (including the County Planning Office, County Water Department and County Agriculture Department). In the words of one respondent: ‘There is a serious capacity deficit, as the responsibility is given based on who is who rather than who can do what...the problem in the county structure is that there are political appointments...very junior people have been appointed as technical advisors and section heads, which have reduced morale of dedicated and senior staff’. The officials in the Isiolo County in Kenya stressed that this is even more evident at the local level (for example there is a lack of well-qualified engineers and skilled labour to attend to breakdown of pumps, pipes, tankers, etc.). In

³ KSWN is an Industry outreach program to bring together disparate stakeholders, with common interests related to areas of water management. For more information, see here.

Namibia and Ghana, budgetary constraints were identified as a key barrier to local responses to crisis even though the other aspects supporting response, such as a clear plan of action, were in place. As a result, in northern Ghana, there is a markedly high reliance on donor funds to provide water services for rural communities. In India, lack of staff at the district and sub-district level was seen as a more critical barrier than budgetary constraints, going against popular perceptions of increasing adaptation finance as an effective way to improve implementation. One of the local organisation directors said ‘Lack of adequate capacity with government line departments is a bigger challenge than shortage of financial resources’. In sum, in different cases, there were different capacity deficits that were constraining the implementation of decentralisation and the associated capacity to foster participation and flexibility across scales, including lack of sufficient budget, inadequate staff and limited technical skills.

Flexibility supports the ability to innovate and adapt

At sub-national levels, ability to innovate is crucial for adaptation to growing water crises (Anguelovski and Carmin 2011). However, evidence from the case studies points to a number of socio-technical lock-ins that hinder the ability to be flexible and innovative. For example in India, the focus on subsidies for borewell digging has led to an individualisation of resources and undermined efforts to incentivise restoration of Kolar’s old system of community water tanks which doubled up as water harvesting structures. This lock-in is exacerbated because borewell digging and tank restoration are managed by different departments. Citing frustration with this siloed approach, a geologist in the Rural Water Supply Department mentioned, ‘Earlier, we were also in charge of building tanks under our Panchayat Raj Engineering Division...but now our role is restricted to rural water supply’. In Ghana, there are projects that provide low-cost technologies to help farmers scale up operations and although considered ineffective or inadequate by the communities, they still persist. For example, community members reported that small surface dams (or ‘dugouts’) provided through some national projects do not adequately store water to last throughout the dry season and some boreholes require expensive or uncommon spare parts that communities are unable to afford or purchase for maintenance. A shift is needed to envision innovation and appropriate adaptations that break out of rigid institutional lock-ins. This could be supported by informal associations that tend to be more flexible than formal organisations (Rodima-Taylor 2012). The learning centric adaptive approach that Pahl-Wostl (2007) suggests is needed for water governance under climate change was lacking in our

regional semi-arid cases. Although in all cases there were elements of learning, it was not well established and so likely to undermine climate change adaptation in the context of local water governance.

In the case of Kenya, decentralisation has allowed the Isiolo county government to improve water services in urbanising areas, protect water services during drought and floods, and avoid unnecessary costs for vehicles and emergency response through better planning. The customary *Dedha* committees in Isiolo (besides the formalised water committees and Water Resource Users Associations) have been revived after formalisation by the county government to manage water and pasture, providing a good example of innovation that has successfully integrated customary and government institutions. Besides encouraging innovation in terms of what works and what does not, this has also resulted in more equitable outcomes (e.g. increased inclusiveness). An official from the Isiolo County Department of Water explained:

One particular development (in water management) after devolution has been the formalization of customary institutions managing water and pasture for which they have to follow the criteria set by the county water department and Water Resources Management Authority. As a result, these institutions have evolved as hybrid structures and have become more inclusive (i.e. inclusion of women and youths). We have also seen good developments in terms of community-private sector partnerships (e.g. in maintenance and functionality of water infrastructures) and effective regulation and control of water theft (i.e. illegal wells and pumps).

In both India and Ghana, national and regional awards have been given to environmentally conscious farmers. In the northern region of Ghana, farmers showcased innovative and sustainable farming practices where they won various awards (Tambo and Wünscher 2015). These incentives can promote shifts towards sustainable practice and behaviour through formal recognition.

In our cases, financial resources have directly impacted on the extent to which sub-national actors have been able to be flexible in their responses. For example, in Namibia and Ghana, many sub-national officials do not have sufficient autonomy over their budget-related decisions which affect how priorities are set and responded to. In Namibia, a lack of budget has meant that the extension officers cannot visit the villages regularly and the Basin management committee has been unable to pay travel costs, and so meetings have not happened.

On the other hand, evidence from India and Kenya illustrates heightened flexibility to respond to crisis due to availability of contingency budgets. This flexibility has been

particularly important during disasters where impacts and responses unfold rapidly. As an official from the National Drought Management Authority in Isiolo, Kenya elaborated:

Devolved authority and resources through the process of decentralisation has also helped us in experimenting and deciding in terms of what works and what does not at the county level. For example, County Department for Water used to rent tankers for distribution of water during the time of drought, which usually are more expensive during that time. They have now purchased two tankers, which will be a good investment in the long run.

Lessons from decentralisation for vertical integration to climate change

This paper has explored how participation and flexibility have been supported through decentralisation in the water sector in four case studies from semi-arid areas of Africa and India. Our analysis has highlighted that decentralisation has not enhanced participation and capacity sufficiently to ensure equitable representation from lower levels of hierarchy or to bring local knowledge into decision-making process across scales as intended, as found in other cases (Terry et al. 2015; Larson and Ribot 2004). For example, in India despite guidelines supporting inclusion, men typically participate more and are often from higher castes and larger landholders. This has resulted in limited impact around improving inclusion of marginalised groups in water governance. Adaptation approaches that aim to support better vertical integration should recognise that substantial resources will be needed to actively ensure that multiple stakeholders at multiple levels of state and society can be part of conceptualising and implementing adaptation responses (Amundsen et al. 2010; Sherman and Ford 2014). This will require a richer understanding of the power differentials and relationships between state and community actors (Aylett 2013) and alignment with the growing focus on collaborative governance and co-production for climate change adaptation (Clarke et al. 2013; Evers et al. 2016; Ziervogel et al. 2016).

Taking this forward, vertical integration could imbibe lessons from numerous multi-stakeholder consensus building and participatory scenario-based processes that have been undertaken the world over that explicitly give voice to participants across scales and encourage bottom-up participation. For example, Transformative Scenario Planning and Vulnerability and Risk Assessment processes conducted across regions as part of the ASSAR project enabled local

and regional actors to stand back and see how their urgent priorities, often related to water access, were part of a bigger social-ecological system (Morchain et al. 2019). Such processes, by design, facilitate a critical understanding of the system as a whole and help to present, argue and assimilate diverse perspectives, contradictions and realities.

In our cases, decentralisation enabled flexibility in some instances where challenges were turned into opportunities and resources allowed for more suitable local responses. Where responses tended to be more effective and flexible, hybrid governance arrangements were in place that included both formal and informal institutions. This important finding aligns with emerging work in the climate adaptation space that supports hybrid and inclusive governance that better responds to diverse needs, particularly of marginal groups (Adhikari and Taylor 2012; Archer et al. 2014; Ziervogel 2019). In other instances, flexibility was undermined by the lack of authority and resources at the local despite the decentralisation policies. Flexibility was also undermined by capacity deficits, lack of technical skills, socio-cultural barriers and unequal power relations. The concept of flexibility has not received sufficient attention in the decentralisation literature but needs to be better understood in order to support vertical integration and build cross-scalar hybrid spaces for innovation and learning (Armitage et al. 2008).

Unfortunately, decentralisation has increased expectations on already resource-constrained local actors, who do not have the capacity or authority for these new roles (Poteete and Ribot 2011). As one of the interviewees in Namibia said, ‘decentralisation... has failed’. A few interviewees in Kenya ridiculed ‘devolution’ as ‘devil-ution’ due to some of the unintended consequences such as expansion of bureaucracy and corruption at the local level, increased contestation and political conflicts and unfulfilled promises (such as empowerment of disadvantaged groups). In all four of our cases, decentralisation has focused more on operational aspects (administrative and technical) and has undervalued socio-cultural and ecological aspects. As the climate change adaptation agenda increasingly gains ground, and vertical integration is supported, it is imperative that socio-cultural and ecological issues are as carefully considered as the administrative and technical issues (Head 2010). Yet in resource-constrained environments, such as our cases and many other semi-arid regions, the capacity to take a more holistic approach is often limited.

No single governance institution can manage a wicked problem alone (Leck and Simon 2013). Decentralisation has relied primarily on government institutions, yet the successful cases often highlight the role of non-state actors. As countries pursue their commitment to the Paris agreement and develop National Adaptation Plans, vertical integration is likely to be increasingly championed. Lessons from our four cases

suggest that successful vertical integration will require strong government engagement across scales and sectors, but that climate change adaptation requires support from a range of intermediaries including NGOs, academics, private and informal actors and institutions (Adhikari and Taylor 2012). If states are weak, engagement, collaboration and implementation on climate adaptation are likely to be hard, especially in countries where short-term development needs are prioritised, and the link to climate change is not necessarily seen as direct (Ziervogel and Parnell 2014). Our cases have highlighted that issues of coordination, responsibility, capacity and accountability can undermine decision-making across scales that aims to strengthen natural resource resilience. But, through these cases, we have started to better understand how each level of governance might enable participation and flexibility. The growing field of adaptive governance that embraces complexity, learning and changing social and environmental dynamics holds some promise for addressing these challenges (Pahl-Wostl 2009; Shinn 2016; Engle et al. 2011).

In conclusion, it is clear that although decentralisation supports participation and flexibility in principle, these goals have been hard to achieve in all of our cases. Given the semi-arid nature of the cases and the increased stress on water from climate change, adaptation is a priority. As vertical integration increasingly receives the support it deserves in National Adaptation Plans and strategic adaptation planning, we suggest three lessons that should be carefully considered:

1. Actively seek equitable representation from marginal and diverse local groups drawing on both formal and informal participation structures.
2. Assess and address capacity deficits that undermine flexibility and adaptive responses, especially within lower levels of government.
3. Use hybrid modes of governance that include government, intermediaries and diverse local actors through both formal and informal institutions to improve bottom-up engagement.

Decentralisation has led to some success in increasing water supply and access both in our cases and in other instances. There has been less success in terms of integrating and encouraging decision-making, participation and implementation at lower levels. Although vertical integration for climate adaptation makes sense in theory, its practical achievements will be limited, if attention is not paid to issues of representation, participation, flexibility and capacity. Unlike decentralisation, climate change adaptation has significant support from NGOs and international funders which may provide some unique opportunities for convening actors across scales to experiment and implement holistic adaptation responses across scales. But, ideals should be matched by examples on the ground.

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